APRIL/MAY 2024

DPH23/GPH23 — QUANTUM MECHANICS – II

Time : Three hours Maximum : 75 marks

Shanmuga Industries Arts & Science College T.V.Malai

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Distinguish between degeneracy and non degeneracy.
2. List out the applications of WKB method.
3. What is meant by time dependent perturbation theory?
4. Give the significance of constant perturbation.
5. State optical theorem.
6. What is meant by scattering amplitude?
7. Show that the Dirac matrices are even dimensional matrices.
8. What is meant by spin magnetic moment?
9. Define bilinear covariant.
10. What is meant by probability density?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Develop the time independent perturbation theory for non degenerate level.

Or

(b) Calculate the ground state energy of the helium atom by variational method.

12. (a) Derive an expression for the rate of transition to the continuum of final states.

Or

(b) Write a short note on sudden approximation.

13. (a) Explain Born approximation in detail.

Or

(b) Illustrate the wave packet description of scattering.

14. (a) Deduce the non relativistic reduction of Dirac equation.

Or

(b) Derive Klein – Gordon equation.

15. (a) Discuss the various properties of gamma matrices.

Or

(b) Obtain the covariant form of Dirac equation.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the time independent perturbation theory for degenerate level.

17. Develop the time dependent perturbation for a harmonic perturbation.

18. Derive an expression for the differential cross section for scattering in a central potential using partial wave analysis methods.

19. Obtain the plane wave solutions of Dirac equation.

20. Discuss in detail about the second quantization of Klein – Gordon field

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